

2018

REQUEST FOR PROPOSAL (RFP) FOR GSAT-29 Ka- Band GROUND SYSTEM

AHMEDABAD EARTH STATION, SNGG

SPACE APPLICATIONS CENTRE, ISRO

DOC: Ka-BAND RFP/GSAT-29 GS/SAC/2018



Request for Proposal (RFP)

**Supply, Installation and Commissioning of
GSAT-29 Ka- Band Ground System**

**SPACE APPLICATIONS CENTRE
INDIAN SPACE RESEARCH ORGANIZATION
AHMEDABAD**

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LIST OF ABBREVIATIONS

RFP	: Request for Proposal
RUT	: Remote User Terminal
OFC	: Optical Fiber Communication
CAMC	: Comprehensive Operation and Maintenance Contract
HVAC	: Heating Ventilation and Air Conditioning
RFEH	: RF Equipment Housing
TWTA	: Travelling Wave Tube Amplifier
HPA	: High Power Amplifier
LNA	: Low Noise Amplifier
NMS	: Network Manager System
TFSS	: Time & Frequency Subsystem
HMC	: Hub Monitoring and Control
TCP/IP	: Transport Control Protocol / Internet Protocol
HTTP	: Hyper Text Transfer Protocol
DDR	: Detailed Design Review

Section-1: Introduction to GSAT-29 Ka x Ka Ground Systems

1.1 Introduction

Space Applications Centre (SAC) located at Ahmedabad, India's one of the major centers of the Indian Space Research Organization (ISRO), Department of Space, Government of India.

The next-generation Ka/Ka communication satellite GSAT-29 is currently under development at ISRO. Ka-band payload will have five fixed beams and one steerable beam. Four fixed beams will cater to high data rate requirements of users in North-East (NE) region and Jammu & Kashmir (J&K) region of Indian Mainland. These spot beams will have intra-beam connectivity i.e. users can communicate within same beams. It can support hub to user links, user to hub links or user to user links within four beams.

The frequency and polarization of Ka-band shall be re-used within NE and J&K beams. There are two Ka-band beacon transmitters over Indian region, in orthogonal polarizations, for pointing of user terminals and hub stations, and uplink power control.

Both J&K and NE region will have two overlapping Ka- Band spot beams. In NE region, one beam utilizes 500 MHz bandwidth in one polarization while overlapping beam will also use same 500 MHz spectrum but in orthogonal polarization. Hence, it will provide 1 GHz bandwidth over NE region.

Same 500 MHz spectrum in both polarizations is split into 400 MHz and 100 MHz bands for re-use over J&K region and steerable/hub beams, respectively. Hence, it provides 800 MHz total bandwidth over J&K beams.

The ground infrastructure for complete GSAT-29 Ka Band system will include two (2) Ka-band hubs: one in J&K and another in NE region. Each hub will have one, diversity site with the capability for seamless switching to counter outages due to rain fades and to provide redundancy. Thus, each of the two hubs will have one active and one redundant (space diversity configuration, total 4 RF stations). The diversity hub will be located at a distance of minimum 10 Km from Main site and connected through OFC link.

The hubs through their common facilities will provide satellite access to the nodal agencies. The hubs shall be suitably configured and equipped to provide full set of features and connectivity.

This “Request for Proposal” is for “Supply, Installation, Commissioning and Maintenance of the complete GSAT-29 Ka- band Ground System Network” comprising two Hub Stations and related equipment, defined in this document.

1.2 GSAT-29 Ka- Band Ground Network

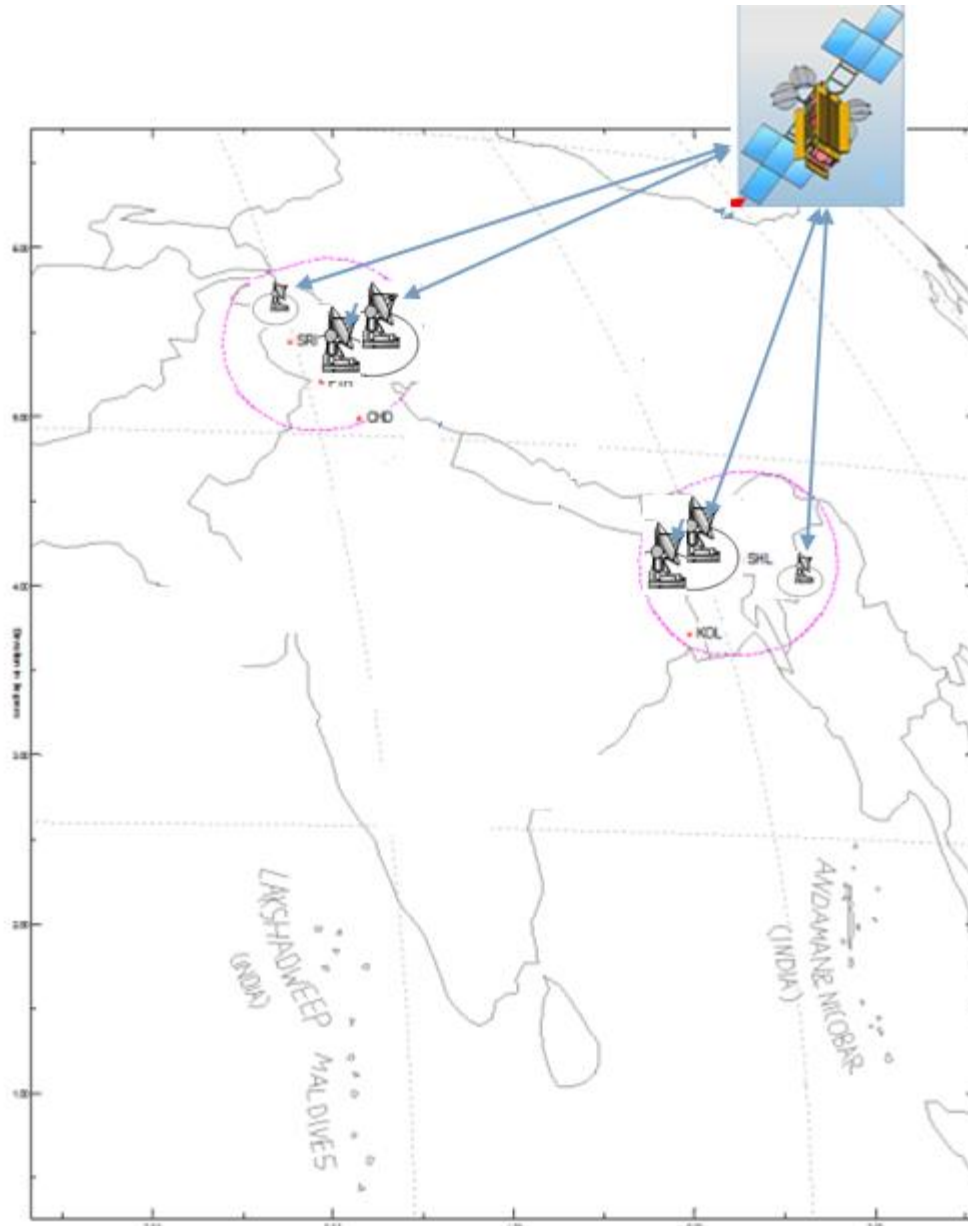
GSAT-29 Satellite will provide Ka-band spot beams for user as well as hubs, covering J&K and NE region. **Figure-1** shows the overall ground system comprising **two** (2) Ka-band hub earth stations.

The GSAT-29 Ka- Band Ground network will consist of following major components:

- 1.J&K will have one hub with diversity site** catering services to two overlapping Ka-band spot beams with frequency and polarization re-use

2. **N-E will have one hub with diversity site** catering services to two overlapping Ka-band spot beams with frequency and polarization re-use
3. Each of the two hubs will have one diversity site with RF sub-systems
4. The Diversity hub will be located at a distance of minimum 10 Km from Main hub and connected through OFC link.

Figure 1: GSAT-29 Ka- band Ground system Configuration



The hubs shall be installed at two different locations in India. The tentative locations of these hubs are Jammu/Chandigarh in J&K region and Guwahati in NE region. However, the exact locations of the main and diversity sites within these places mentioned will be decided at the time of DDR.

Table-1 provides hub Geo Location of the sites:

Table-1: Site Geo Locations (Tentative)

Hub Station		
Place	Latitude (in deg)	Longitude(in deg)
Jammu/ Chandigarh	32.73/30.73	74.86/76.77
Guwahati	26.14	91.74

1.3 Gateway Description

1. Each Gateway station will be connected to corresponding diversity stations at L-band.
2. Only Antenna & RF sub-systems will be installed at both main and diversity sites
3. Main hub will be master and should take care of seamless switchover process and delay compensation associated with RF switchover to diversity sites in case of rain fade. Dark fiber (OFC) will be arranged by the purchaser.
4. The RF systems will have to provide L-band interface to connect multiple baseband equipment (up to 4) housed at Main Gateway stations for establishment of communication network. L band interface connector details (i.e. SMA, N type) will be finalized during DDR.
5. It should be possible to operate the hubs independently or from a common control site, which may or may not be co-located with any of the two hubs.

Section-2: RFP Details and Guidelines

2.1 Scope of Work

GSAT-29 Ka- band ground network will consist of **two (2)** main hubs along with diversity hubs associated with each main hub and RUTs installed across beams in J&K and NE region. **However, the RUTs are not under the scope of this RFP.** The Hub will be 24x7 operational. A good maintenance of hub from the vendor is also being envisaged. So, Comprehensive Annual Maintenance (CAMC) of these hubs also comes under the scope of work apart from installation, commissioning, testing and operationalization of network.

The broad scope of work for prime vendor (Here after called as vendor) includes the following:

1. Supply, Installation, Commissioning, testing and Maintenance of two main hubs with their diversity hubs (total 4 hubs) along with associated sub-system redundancy.
2. The implementation of the project includes system engineering, associated design and development, supply of hardware & software, installation, integration, commissioning, testing and operationalization of complete network.
3. The establishment of basic hub infrastructure using state-of-the-art, cost-effective commercially available systems.
4. Each hub should have L- band interface for installation of baseband equipment (**PLEASE NOTE BASEBAND IS NOT IN SCOPE OF WORK**) for creating communication network with suitable power and interface control mechanism.
5. OFC link between main and diversity gateways (with 1:1 redundancy in two isolated geographical paths) will be provided by purchaser and is not the responsibility of vendor. However, vendor will have to provide necessary equipment to interface with OFC at main & diversity stations for all gateways including Optical Line amplifiers, if necessary.
6. Vendor should provide connectivity between antenna & equipment room using OFC / L- band cable for both main and diversity site. However, baseband equipment and its installation is not in the scope of this RFP.
7. The vendor has to provide a warranty for 3 years, which includes comprehensive maintenance. Vendor has to provide quote for comprehensive maintenance for 3 years (4th, 5th and 6th year) after completion of 3-year warranty period. Vendor has to purchase all the critical spares, test and measurement instruments in consultation with OEM. The critical list of spares and test instruments will be verified at the time of handing over the site and will be kept in the custody of the vendor.
8. Vendor shall also accept extension of comprehensive maintenance for a period of next 4 years (7th, 8th, 9th and 10th year). However, the cost of this extended comprehensive maintenance will **not** be considered for L1 selection criterion. And ISRO reserves the right whether to take this extended CAMC or not.
9. The vendor shall provide technology and spare support for hardware and software for a period of 10 years.

10. Vendor shall provide four days hands on training on hub operations and preventive maintenance for 10 persons free of cost at one location finalized by purchaser.

2.2 Responsibilities of Vendor

Table-2 defines vendor's responsibilities for entire work involving the establishment & commissioning of hub infrastructure

Table-2 Vendor's Responsibility

SN	Vendor's Responsibility
1	To understand all the requirements and scope of work completely
2	Provide system engineering calculations along with the proposed hardware to meet the requirement, as projected in this RFP
3	Provide requirement of space for equipment and electricity.
4	Submit a comprehensive list of deliverables along with the offer with price masked for any/all proposed configurations
5	Provide detailed cost break-up as part of the offer in the commercial bid
6	Provide delivery schedule as part of the offer
7	<p>Prepare the detailed design review (DDR) document and make presentation during the DDR to the technical committee appointed by SAC. It will be mandatory for the vendor to close all actions generated during this review. Closure of actions will be without impact on cost.</p> <p>This review should also provide system engineering details, Hub station, operational details, monitoring and maintenance considerations etc.</p> <p>Complete Mechanical details (FE Analysis for antenna assembly and support structure against RF specification, Racks dimension, Housing details etc)</p>
8	Prepare, discuss and submit Acceptance Test Plan (ATP) to SAC. Changes suggested by SAC during DDR should be implemented by the vendor.
9	Carry out soil survey, site preparation, antenna pedestal and other construction work.
10	Vendor shall provide the test reports for all sub-systems (eg. Antenna, Feed system, LNA system, high power amplifier, (HPA) Block up/down converters (BUC/BDC), Test Loop Translator (TLT), and other sub-systems etc.) and get it approved by SAC before dispatch
11	Transportation of equipment to the respective site
12	Integration of the Hardware and Software of system

13	Installation, commissioning and testing of the complete ground system including Hubs as per the requirements given in this RFP
14	Vendor shall perform acceptance tests as per approved ATP document
15	Vendor shall provide list of all deliverables including cables, connector, waveguide, patch panel etc. in their proposal.
16	Supply documentation, relevant OEM certificates, performance report of all subsystems and manuals in hard and soft copies
17	Provide 24x7 technical support as and when required
18	<p>Vendor shall submit comprehensive maintenance plan for services during warranty period of 3 years.</p> <p>After completion of warranty period, vendor must submit quotation for comprehensive maintenance services for next 3 years (4th, 5th and 6th year).</p> <p>Vendor must commit for supporting extended comprehensive annual maintenance contract (CAMC) services for 7th, 8th, 9th and 10th year, if desired by the purchaser. However, the purchaser reserves the right to proceed or not to proceed with such extended CAMC with the vendor.</p> <p>Vendor should also explain their strategy for CAMC. Annexure-1 shows details of CAMC.</p>
19	Vendor shall provide a list of inventory of critical spares, which the vendor will maintain for maintenance of services, along with offer.
20	The selection of the sub-systems of ground system should be done in a manner to ensure the continuity of service for at least 10 years (preferably 15 years) for the Hub sub-systems.

2.3 General Guidelines to the Vendors and Other Conditions

1. The offer must contain sufficient data and material to prove that bidding vendor possesses 5 years or more than 5 years of experience as on the date of opening the technical bid in the similar type of work, like handling the project of the similar nature, involving end to end system engineering, design, delivery, installation & commissioning involving large antenna installation as described in this RFP. Vendor should submit the relevant documents clearly and unambiguously stating their previous experiences in executing similar type of work. For antenna hub system, the required experience is as follows:
 - a. Large antenna installations of 7.5 meter and above with tracking system

b. Frequency of operation – C/ext-C/Ku- Band or above

c. Simultaneous transmit and receive capability including interactive networks

All these above specified experience has to be for the same antenna installation set-up. Thus any antenna hub installation meeting all of the above stated three criteria will only be considered for the experience as similar type of work. **These are mandatory conditions which should be met for qualification of vendor's bid.** The vendor should give the details of experience as per format provided in the Annexure-5. Only those experiences which are backed by relevant unambiguous documentary evidences/proofs will be considered during evaluation. **Experience of OEM alone will not be considered for evaluation.**

2.The vendor should have sufficient experience, resources and capability, in India, to execute project of the magnitude proposed in the RFP, involving supply, installation, operations and maintenance. Bidder shall provide documentary evidence to substantiate these.

3.Vendor shall comply to all the specifications, deviations if any shall be mentioned in a separate table and provide justification how these deviations will /will not hamper the overall performance of the system. Any improvement shall be separately brought out in the offer.

4.The overall configuration and implementation plan should be clearly explained with the help of block schematic of the complete system. The offer should also include the technical justification of choosing each sub-system with respect to the goal of meeting overall system specifications and other requirements.

5.The vendor must provide a Statement of Compliance (SoC), covering each point of system and sub-system specifications of complete earth station system as mentioned in respective sub-system details. SoC by bidder but not supported by OEM or OEM datasheet is not acceptable. **In case of any discrepancy between OEM datasheet and compliance statement, OEM datasheet will be considered final and binding.** This SoC should be well supported by documentation consisting of data sheets, brochure, calculations,

literature etc. All relevant details of each subsystem like make & model number, detailed specifications, block schematic, if possible test data sheet etc. should also be provided.

6. After receiving the offers, Vendors will be invited if found necessary to make technical presentation on their offer to an evaluation committee at SAC. Vendors will be required to provide clarification, if called for, by the evaluation committee, on any matter related to offer.

7. Vendors may further note that SAC (ISRO) also reserves the right of not considering an offer, if there are any deviations in the commercial and/or general terms and conditions offered against the requirements as per this RFP, even if the offer is technically suitable.

8. **Consortium bidding is not allowed for this RFP.** SAC (ISRO) shall assign the overall responsibility of implementation on a single vendor (prime vendor) for the entire works. Any dependency on any sub-contractors shall be managed by the prime vendor and should not have any bearing whatsoever on SAC (ISRO) and the performance of the final contract. However, the prime vendor must specify the source/partner against the proposed systems and the services which includes information like work/business profile of such a supplier, experience in executing/supplying similar type of system/subsystem for which the subcontract is **being** awarded, etc.

9. Bidder / OEM blacklisted by any Govt. of India organization is not eligible for participation in the bidding process. The total bid will be summarily rejected involving any of such bidder or OEM in the bid, without any prior notice.

10. The responsibility of safe transportation / delivery of total system to the site rests with the Vendor. This includes:

(i) Transportation from factory to the site

(ii) Loading / unloading where applicable during transportation.

(iii) Transit insurance

All expenditures for above activities shall be borne by the Vendor. SAC (ISRO) will provide custom duty exemption certificate and other such certificates, whenever applicable and requested.

The vendor must project the requirements like custom duty exemption (CDEC) etc. at the time of Bidding.

2.4 Preparation and Submission of Bids

Bids shall be submitted in two separate parts in sealed envelopes.

Part-1: This part should contain complete technical proposal. This section should bring out complete clarity on the total work involved including conceptualization, implementation and performance. This part should include following information but not limited to:

- a) Technical Compliance Statement (Point by Point Compliance) to full RFP including all tables
- b) Each Subsystem detail with complete specifications
- c) Implementation details including subsystem I/O interface details, signal flow diagram, level diagram etc.
- d) Each Subsystem detail with complete specifications. **Vendor must note that multiple OEMs are not allowed for a single subsystem. Vendor should submit single solution for this RFP. Submitting multiple solutions is not acceptable and offer is liable to be rejected.**
- e) The level diagram shall indicate the nominal power input and output of each subsystem and should ensure that none of the subsystems eg. BDC, BUC, LNA, HPA etc goes into saturation
- f) Complete Mechanical details (Indicative FE Analysis for antenna assembly and support structure against RF specification, critical frequencies, Racks dimension, Housing details etc.)
- g) Simulation results of RF and antenna control system should be provided during bidding / DDR as and when needed.
- h) Complete Civil Work requirements (Antenna Pedestal design, suggested overall building and housing outline drawings, clearly specifying area needed for the Hub, air-conditioning, electricity, water etc.).
- i) Clearly specify space & power needed for the Hub
- j) Hub commissioning, characterization & acceptance test plan
- k) Time Schedule with reference to major milestones
- l) Comprehensive onsite Warranty for three years
- m) Comprehensive Maintenance plan considering 24x7 uninterrupted operations for 4th, 5th and 6th year after completing 3 years of warranty.
- n) This should also include spares policy, plan for preventive and corrective maintenance or any other relevant details during warranty and CAMC.

- o) Obsolescence management plan
- p) All papers and documentation of part-2 **Without Price (Price masked)**.
- q) All sub-systems must be quoted (**Price Masked**) along with **make** and **model** number
- r) Disclosure of the price in technical bid will lead to **disqualification** of the bid without any further queries

Part-2: Commercial offer covering entire scope of activity, giving complete cost break up, of the following but not limited to:

- a) Cost of site preparation and civil work for antenna foundation (pedestal).
- b) Cost of Antenna & RF subsystem
- c) Cost of de-icing for the antenna must be quoted (optional and not part of the L1 criterion)
- d) Cost of hardware & software for Hub Monitoring and Control (HMC) System
- e) Cost of CAMC
- f) Cost of Comprehensive Maintenance Contract (CAMC) for three years after three years (4th, 5th and 6th year) of comprehensive warranty
- g) Any other costs such as integration, fabrication, testing, licensing etc. which are not reflected above, towards realization of systems under the scope of this RFP

2.5 Criteria for selection of lowest offer (L1):

Following table gives the item description which are tentatively considered for L1 criteria:

SN	Item description	Qty
1.	Antenna system including reflector structure monopulse feed assembly and mount structure, control system with drive electronics, civil foundation including installation, commissioning and ATP	4 sets (2 per site)
2.	Monopulse tracking system and associated electronics	4 sets (2 per site)
3.	LNA, HPA, BDC, BUC system with redundancy and including associated cabling	4 sets (2 per site)
4.	Hub Monitor and Control (HMC)	2 sets (1 per site)
5.	TLT, time & frequency reference system & IF distribution system	4 sets (2 per site)
6.	Test equipment	2 sets (1 set per site)
7.	3 years (1 st , 2 nd , and 3 rd year) comprehensive warranty for overall system with CAMC terms and conditions mentioned in Annexure-1	4 sets

8.	CAMC for 4 th , 5 th and 6 th year	4 sets
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All optional items mentioned in this RFP must be quoted. However, SAC reserves the right to include it in Purchase Order (PO) or not.

2.6 Delivery & Schedule

Delivery schedule of the complete ground system including installation, commissioning and testing shall be defined in the offer by the vendor. Delivery schedule should be 6 months ARO (After Receipt of Order) including installation & commissioning testing.

The delivery schedule must address major milestones including following

Table 3: Time Schedule

S N	Major Milestones	Schedule
1.	Detailed Design Review (DDR) at SAC and Ground System Acceptance Plan Document Submission	
2.	Close out of DDR actions	
3.	Site Preparation (Antenna foundation etc, site wise schedule)	
4.	Antenna & RF installation	
5.	RF System Characterization	
6.	Total Ground System Acceptance	
7.	Commencement of operations	

2.7 Warranty and Maintenance

1. The Vendor shall provide **comprehensive on-site warranty** including maintenance and spares for a period of 3 years for the complete earth station system and sub-systems from the final date of acceptance.
2. The acceptance test is to be conducted with GSAT-29 satellite or any other satellite operating in same band; however, the acceptance test plan should also contain a contingency test plan in case the satellite is not available by the time ground system installation is completed.
3. The terms and condition for repairs / services during the warranty period shall be clearly indicated by the vendor while submitting the offer.
4. The detail of CAMC is given in Annexure-1

Section-3: Technical Details of Satellite Transponders

3.1 Technical Specifications

The major specifications of Ka x Ka transponders are given below:

Table 4: Ka X Ka Transponder Specifications

SN	Parameter	Unit	N-E Beam	J&K Beam
1.	Receive Frequency band	MHz	28801-29301	28801-29201
2.	Transmit Frequency band	MHz	18100-18600	18100-18500
3.	On-board LO	MHz	10701	10701
4.	Saturation Flux Density (SFD) at max FGM gain	dBW/m ²	-96 ± 2	-96 ± 2
5.	SFD Range			
	-FGM	dBW/m ²	-96 to -80	-96 to -80
	-ALC	dBW/m ²	-96 to -80	-96 to -80
6.	Receive G/T (min)	dB/K	+8	+8
7.	Transmit EIRP (min)	dBW	57	57
8.	Polarization Sense			
	- Transmit		Linear-V/H	Linear-V/H
	- Receive		Linear-H/V	Linear-H/V
9.	Number of Transponders	#	2	2
10.	Usable Bandwidth per Transponder	MHz	450	360
11.	Multibeam system C/I min	dB	16	16
12.	Beacon Frequency	MHz	19701.5	19701.5
13.	Beacon EIRP	dBW	21	21
14.	Polarization sense for beacon		Linear-H	Linear-H

Section-4: Technical Specifications of Antenna and RF Subsystems

4.1 Technical Details of Hub Stations

The representative baseline configuration of the hub is given in Figure-2. This Section provides details of antenna and RF section of hub.

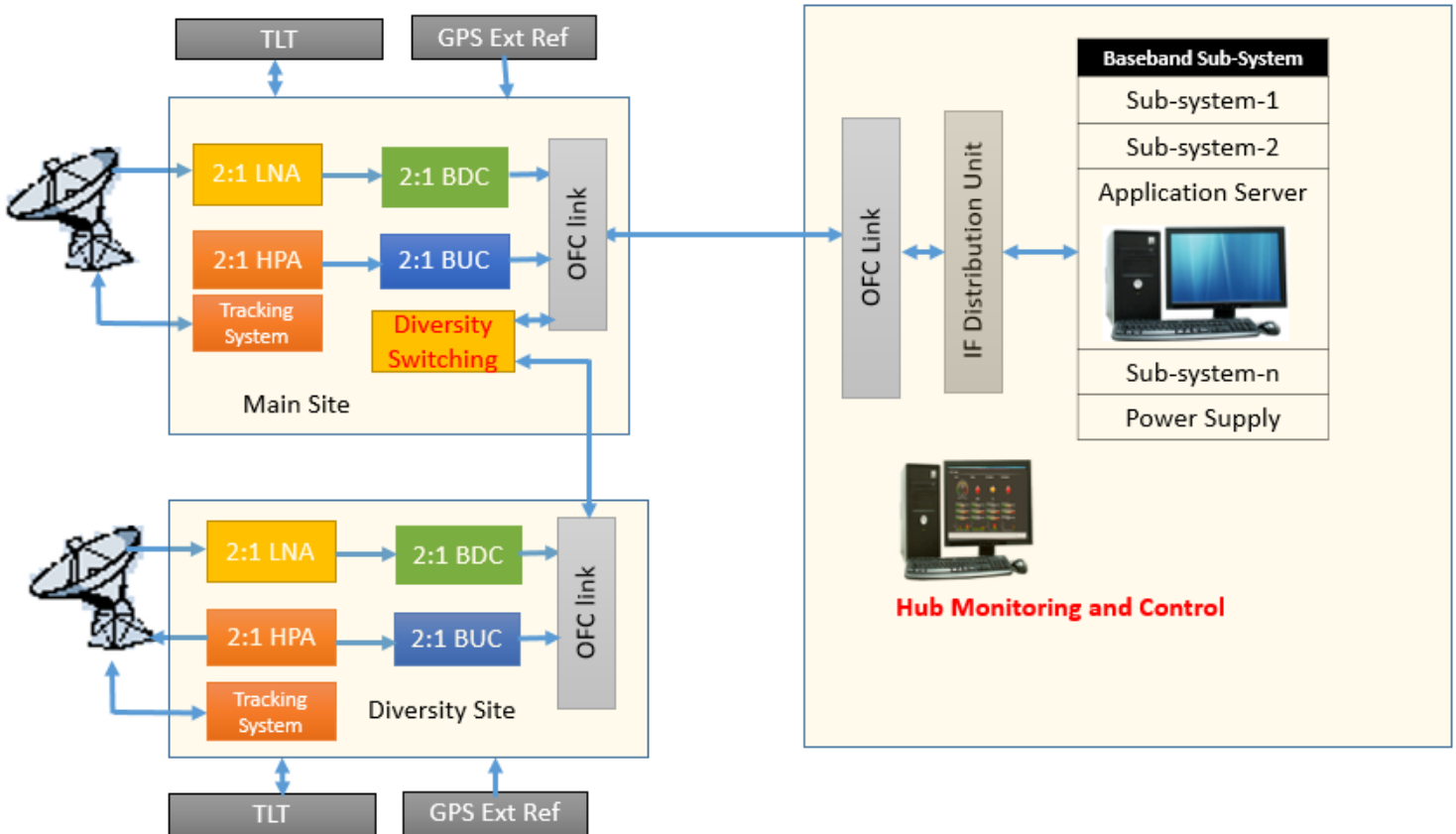
Mandatory Features

Each earth station antenna & RF system is proposed to have (but not limited to) the following features:

Table 5: Mandatory Features of hub Stations

SN	Features
1.	Steerable dual reflector antenna system consisting of main reflector diameter ≥ 9.0 m (nine meter) with four port feed, associated electronics, backup structure, sub reflector, lightning arrestors, HVAC, rain blower, dehydrator, de-icing (optional) etc.
2.	Antenna drives to have pointing capability to cover all satellites in the geo stationary arc of 40^0 E to 120^0 E visible to India.
3.	Antenna Control System (ACS) with drive electronics including tracking down converter and beacon receiver for satellite tracking
4.	Antenna foundation, Elevation & Azimuth pedestals in El over Az configuration.
5.	Two receive chains for simultaneous reception of orthogonal linearly polarized signals.
6.	Two transmit chains for simultaneous transmission of orthogonal linearly polarized signals with Uplink power control in each.
7.	Redundant RF electronics (LNA, Block Up/Down converters and HPAs).
8.	Seamless automatic change over from main hub to site diversity for rain fade mitigation. Also, there should be provision for switching between RF and diversity site manually, if required.
9.	Delay compensation / Network Synchronization system between main & diversity Gateway for uninterrupted communication.
10.	Time & frequency reference disciplined to GPS with provision for external reference
11.	L-band IF interface /OFC connectivity with hub equipment.

- | | |
|-----|---|
| 12. | Centralized Hub equipment (all RF equipment) Monitoring and Control (HMC) facility with IP based solution for remote operation. |
|-----|---|



*** Baseband Sub-System is not under the scope of this RFP.**

Figure 2: Representative Configuration of hubs station

4.2 Brief Description

The representative earth station base line configuration of antenna and RF system is shown in Figure-2. It shall have capability to transmit & receive multiple carriers in linear polarizations at Ka- band. The bidders must quote single solution against this RFP.-

As shown in Figure-2, transmit configuration has L- band input signal, which is combination of multiple digital modulated carriers available from baseband system. This signal is up converted and transmitted by earth station in Ka- band. In transmit chain, the redundancy configuration is 2:1 (two active with one hot standby) for block up converter and HPA subsystems in order to increase earth station flexibility and availability during equipment failures.

In receive chain, LNA and block down converters have 2:1 (**two active with one hot standby**) redundancy similar to transmit chain. The down converted L- band signal is obtained from the output of block down converter, which is given to base band section.

The antenna has 4-port linear feed with HVAC system. Tracking chain contains tracking down converter, beacon receiver, motors, encoders and antenna control unit (ACU) etc with cold redundancy. The tracking used is monopulse and feed should support it. Any other sub-systems required for monopulse tracing should be supplied by vendor.

The RF system shall have a TLT to test the Tx and Rx chain's RF performance in the absence of satellite. Appropriate test couplers, dummy load and other accessories for the Rx and TX chain are to be supplied by the vendor.

Two types of Link Management Techniques (Uplink power control (ULPC) and Site Diversity) to be provided for rain fade compensation. Bidder should provide recommended sequence and a suitable hysteresis mechanism to avoid frequent in-appropriate switchover in detail.

The uplink system shall have capability for 20 dB (typical) uplink power control range with suitable interface. The system should have provision for to/from switching of L-band IF signal for meeting site diversity requirements. The vendor should note that the system should run with multiple outbound and multiple service providers to be integrated with the system.

All RF equipment shall have M&C facility for remote control operation through a central console: Hub Monitor and Control (HMC) with IP based solution for remote operation shall be provided.

The antenna section hosts all RF equipment like antenna and feed, HVAC system, antenna motors, encoders, HPA systems, waveguide switches, attenuators, dummy load, block up converters, LNA subsystem, block down converters, control logic system, time and reference frequency generation & distribution system etc.

Preferably, up link & down link L- Band signals should be converted to optical signals and brought to the baseband building through OFC for baseband equipment connectivity. Alternatively, direct L- band interface to baseband equipment can also be considered with suitable gain slope equalizer.

For site diversity switching, OFC link interface for transmit (both: LV & LH) and receive (both: LV & LH) systems is to be provided.

4.3Hub Specifications

The major specifications of the hub station to be complied by the vendor are as given in Table-6.

Table 6 : Hub System Specifications

SN	Parameter	Specification
1.	Frequency of operation (Antenna &Feed) Transmit Receive	28.8-29.5 GHz 27.5-31.0 GHz (Desirable) 18.0-18.7 MHz 17.7-21.2 GHz (Desirable)
2.	Beacon frequency for tracking	19.7015 GHz
3.	Antenna diameter	≥ 9.0 meter
4.	Antenna Mount	Elevation over Azimuth
5.	EIRP	86 dBW, minimum with 25 dB NPR (Provide EIRP break up table in the quote and also provide HPA configuration and sizing details to meet the above minimum EIRP requirement and provide detail block schematic. It must also include feed loss, all coupler loss and HPA assembly loss, if any)
6.	EIRP Stability Over a day	± 1 dB (vendor to provide break up including HPA gain stability, BUC stability and antenna pointing & tracking errors)
7.	Transmit Flatness over RF frequency band Full Band Any 40 MHz	$\leq \pm 1.0$ dB $\leq \pm 0.25$ dB
8.	Up-link power control range	20 dB
9.	G/T at 20° EL	39 dB/K, minimum (Provide break up table in the quote indicating feed loss coupler loss and any other component between feed and LNA system)
10.	Tracking Mode	Manual, Program & Auto (Mono pulse, Step track)
11.	Polarization (Tx./Rx.)	Dual Linear orientable (Vertical & Horizontal simultaneous)

12.	Tx./Rx. Side lobes envelope	ITU-R Rec. S.580-5 (Vendor shall provide Tx/Rx radiation pattern extended cut patterns more than +/-10 deg and ITU mask superimposed over it)
13.	Peak Pointing error	Maximum Average RMS pointing error should not exceed 1/4 th of 3-dB Rx beam width for winds of 60 km/hr gusting to 80 km/hr (Provide break up in the quote)
14.	Peak Tracking error	Maximum Average RMS tracking error should not exceed of 1/10 th of 3-dB Rx beam width for winds of 60 km/hr gusting to 80Km/hr (Provide break up in the quote)
15.	Travel rate of the antenna Az El	0.02 - 0.5 °/sec or better 0.02 - 0.2°/sec or better
16.	Acceleration	0.2°/sec ² or better in AZ axis 0.2°/sec ² or better in EL axis
17.	Travel Range	Azimuth: 120 deg+/- 60 south sector Preferable 180 ⁰ (± 90 Deg.) preferable Elevation: 5-85 Deg. (0 to 90 deg desirable)
18.	Angular resolution	Better than 0.001 °
19.	Polarization movement	Polarization to match spacecraft polarization angle within 1 degree (0.2 degree preferable) (Linear rotatable: ± 100 deg) through motor with digital display
20.	Feed Assembly	4-Port, Tx/Rx Linear Polarized; capable of transmitting and receiving both polarization, simultaneously
21.	VSWR	≤ 1.35:1 for Tx port, Rx port and at beacon frequency 19.7015 GHz
22.	Cross-Pol Isolation (Tx. , Rx)	≥ 30 dB within 1dB beam width
23.	Power handling capability	≥ 500W CW per port (1KW total)
24.	Port-to-Port Isolation	
	Tx-Tx/Rx-Rx	≥30 dB
	Rx-Tx/Tx-Rx	≥ 85 dB

Transmit system (Block UP Converter Specifications)		
25.	Input frequency	950-1950 MHz min
26.	Output frequency	28.5-29.5 GHz min
27.	Spectral inversion	No
28.	Tx. Phase noise	Better than IESS 308/309 standard
29.	Spurious	65 dBc minimum up to 0 dBm output
30.	Gain	≥ 30 dB
31.	Gain control	
	Range	20 dB
	Step size	0.5 dB or better
32.	Group Delay	4 ns p-p maximum over any 40 MHz band
33.	Tx Frequency Stability	
	Over Temperature	$\pm 5 \times 10^{-8}$
	(0 to 50°C)	
	Over a day	5×10^{-9} or better
34.	External Reference Input	10 MHz, auto take over from external to internal in case of external reference failure, for all equipment
HPA Specifications		
35.	AM/PM conversion	$\leq 2.0^\circ/\text{dB}$
36.	Noise Power Ratio	19dB at 4 dB OBO(typical) 22 dB at 5 dB OBO (typical) 25 dB at 6 dB OBO (typical)
Receive System (Block Down Converter Specification)		
37.	Input frequency	18.0-19.0 GHz min
38.	Output frequency	950-1950 MHz min
39.	Spectral inversion	No
40.	Gain	≥ 20 dB
41.	Gain control	
	Range	20 dB
	Step size	0.5 dB or less
42.	Receive Gain Flatness over RF	$\leq \pm 1.0$ dB

	frequency band Full Band Any 40 MHz	$\leq \pm 0.25$ dB
43.	Group Delay	4 ns p-p maximum over 40 MHz band
44.	Image rejection	Better than 60 dB
45.	Rx. Phase noise	Better than IESS 308/309 standard
46.	Spurious	65 dBc minimum up to 0 dBm output
47.	Spurious (Signal independent)	-75 dBm maximum
48.	Rx Frequency Stability Over Temperature (0 to 50°C) Over a day	$\pm 5 \times 10^{-8}$ 5×10^{-9} or better
49.	External Reference Input	10 MHz, auto take over from external to internal in case of external reference failure for all equipment
Station Reference Timing source		
50.	Time & frequency reference generation	GPS disciplined with a provision for connecting external source
51.	Frequency	10 MHz
52.	Level	0 to ± 3 dBm
Test Loop Translator		
53.	Provision to carry out local loop testing	Through Test Loop Translator
54.	Input Frequency Range	28801-29301 MHz
55.	Output Frequency	18100-18600 MHz
56.	Gain Control	25 dB in 0.5 dB steps
57.	Third Order Intercept	+18 dBm
58.	Frequency Stability	$\pm 5 \times 10^{-8}$, over operating temperature 1×10^{-8} /Day typical
59.	Phase Noise	As per IESS 308/309 standard
60.	External Reference Input	10 MHz @ 0 dBm ± 3 dB
Interface between antenna and equipment room		
61.	Link to equipment room	L-band (OFC can be considered)
62.	Spare IF interface	Transmit/Receive both

63.	Distance	100m typical
64.	IF Link Equalizer	With 20-dB gain minimum at center frequency, slope adjustment range adequate to equalize the total gain slope
Site Diversity Link		
65.	Site diversity Link	OFC
66.	Spare OFC interface	Transmit/Receive both
67.	Site diversity distance	typically 10 km to 20 km
Monitoring & Control		
68.	Monitoring and Control	All equipment shall have provision for monitoring and control from local and remote location. TCP/IP interface is desirable
69.	User interface	GUI
70.	Operating System	Latest versions of Windows with Upgradations
Prime power		
71.	<p>The vendor shall give details of prime power requirement for the antenna and Electronics. The power distribution shall be done by the vendor.</p> <p>Note: The prime power available in India is 240V $\pm 10\%$, 50 Hz$\pm 3\%$ for single phase and 440 V for three phase.</p>	

4.4Antenna System

The antenna system is the outdoor unit and shall be complied for the requirements given in Table-7.

Table 7: Antenna and RF requirements

Detailed Scope of work	
1.	<p>The Antenna subsystem should include (but not limited to) the following components/items:</p> <ul style="list-style-type: none"> i. ≥ 9.0 m diameter Ka-Band antenna, drive along with 4-port linear polarization feed with tracking system accessories ii. Appropriate antenna mounts with riser and work platform iii. Rain blower iv. RF Equipment Housing (RFEH) containing all RF Subsystem with air

	conditioning v. Dehydrator system for antenna, Lightning protection system and aviation alarm lighting. (vendor should provide specifications of dehydrator to meet the requirement to maintain 0.5PSI nominal pressure)
2.	Carry out soil testing. The test report shall include SBC (Safe Bearing Capacity) and should be presented in DDR. The results of soil testing report must be used for designing or carrying out modifications in the Antenna foundation if called for.
3.	<p>The wind loads data, complete mechanical analysis for antenna assembly and support structure for meeting RF specification. These should include the following and presented in DDR:</p> <ul style="list-style-type: none"> • FE Analysis for antenna, antenna RF Equipment Housing (RFEH) behind antenna • Details like foundation bolts size, clearances and interface requirements • Reflector panels and back up structure • Sub reflector fixture and supporting spars • Pedestal, screw, El / Az platform • Provide free vibration analysis with bending and torsion as part of dynamic analysis • Generate time-dependent wind loads from available meteorological data as part of the dynamic analysis, to estimate the dynamic stresses for these time-dependent extreme load conditions. • Final sets of drawings (assembly drawings, interface drawings, drawings related to maintenance of antenna systems and subsystems etc. including soft copy)
4.	DDR documents to contain all the important results like maximum stresses in critical members, maximum deflections, and natural frequency of total antenna system etc.
5.	DDR document should also contain the complete simulation or test result for the antenna system RF performance.
6.	Submit a detailed “alignment plan” with all relevant details in DDR including main reflector panels, integrated reflector, sub-reflector and feed
Installation and Commissioning:	
7.	Arrange necessary equipment, tools and cranes/ materials handling equipment required for installation/assembly.
8.	Carry out civil work for antenna foundation and pedestal after approval from

	SAC
9.	The antenna and antenna structure and associated hardware shall be protected from environment by using paints, hot dip galvanized or stainless steel and other appropriate measures as required.
10.	Vendor shall preferably use suitable commercially available drives to meet the pointing and tracking requirement.
11.	Antenna system shall have the provision for stow-locks in both Azimuth and Elevation axes. Hand-cranks shall also be provided in both the axes for moving the antenna to stow-lock position.
12.	Lightning arrestors shall also be provided on the reflector for protection against lightning under all conditions.
13.	Cable-wrap or any other suitable arrangements to be provided to avoid cable twist during antenna rotation.
14.	Beacon lights (aviation alarm) shall be provided.
15.	Antenna RF Equipment Housing (RFEH) The RF electronics should be installed in air conditioned equipment room (RFEH) located immediately behind the antenna reflector. The RFEH layout shall be optimized to provide convenient & safe access with features that increase system availability by providing quick, safe and easy methods to replace electronics without affecting RF performance. Utility outlets and lights shall be provided to aid maintenance in the RFEH .
16.	Vendor should include a detailed “RF equipment housing plan (RFEH)” in the DDR.
17.	List of Test and measurement equipment for installation, testing and maintenance should be provided by vendor during DDR. Equipment to be arranged by vendor.

4.5 Hub Monitoring and Control (HMC)

HMC is a central console for monitoring and control all Earth station RF sub-systems. The HMC system will be independent of baseband system.

Table 8: Features of HMC

SN	Features
1.	Click and point interface like windows for easy control to network operator.
2.	IP based solution for remote operation with provision for accessibility from other hub station.

3.	One HMC per hub (at main site) to support the local operations and remote control of diversity station
4.	Automatic configuration management to configure earth station for different operational requirements.
5.	Multi-level authentication/password protection
6.	Feature level as well as equipment level access right to operators.
7.	Report Generation based on types of equipment, time of day, specific event, severities, particular users etc.
8.	GUI to show the live information/ parameters values of the earth station equipment.
9.	Site Diversity switching management (provide detail sequence of diversity switching)
10.	Monitoring and display of RF parameter, Antenna control system Parameters, and RFEH environmental parameters with provision for logging and exporting of data in graphical representation or spread sheet.
11.	Generation of alarms in all abnormal conditions and provision for notification through SMS/Emails etc
12.	Appropriate virus/firewall protection and upgradation during the period of contract
13.	Vendor to give consent for incorporating any changes in HMC during DDR if asked for, without any cost implications.

Note: Vendor to note and agree that SAC reserves the right to procure two more Ka band stations at same price ,terms and conditions given in your quote within time period of one year from date of submission of tender.

Section-5: Site Preparation/Civil Work for Establishment of hub Stations

5.1 Site Readiness

Site activity is to be done as per Table-10.

Table 9: Site preparation Activity

SN	Features
Planning	Obtain available site information from SAC/ISRO
	Ensure obtaining proper permits Visit site and conduct detailed site investigation
	Review, verify, and evaluate site conditions and take photographs.
	Determine site work required.
	Perform site land survey, site grading survey, and take soil borings.
	Measure soil grounding conditions (electrical resistivity and fall-of-potential tests)
	Document as-built conditions on drawings
	Analyze requirement of infrastructure for OFC between antenna and control room
Design	Prepare Site Preparation Requirements and Installment Plan (SPRIP):
	Document specific site design requirements and discrepancies.
	Present method of accomplishing work.
	Present detailed site installation drawings and specifications.
	Provide installation schedule.
	Present site photographs.
	Stage all site material at central staging area.
	Submit SPRIP to ISRO.
	Inform ISRO of readiness to proceed with site installation when all permits and material are received.
Installation	Receive notice to proceed from SAC.
	Deploy material and implementation team to site.
	Trench and install conduit from utility demarcations.
	Antenna Centre point (Lat, Long) marking and true north referencing
	Install foundations.
	Install RFEH with electrical work, smoke/ fire alarm system,air conditioning
	Install grounding and lightning protection systems
	Install equipment racks and configure RFEH
	Install antenna cabling and interface wiring
	Installation, commissioning and testing
	Perform acceptance test and commissioning.
	Assemble and prepare site O&M manuals.
	Train operators for on-site maintenance and operations.
	Perform site cleanup and close-out procedures.
	Provide as-built documentation and training manuals.
	Conduct final site acceptance for sign-off.
	Implement warranty support.

ANNEXURE-1

Comprehensive Annual Maintenance Contract (CAMC) for Ka-band hubs

Scope of Work:

Techno-commercial proposals from vendors are invited to provide Comprehensive on Site Maintenance Services for hubs. Vendor has to carry out following activities.

- 1) Comprehensive On Site Maintenance Services for **two main and two diversity hubs** delivered as per this RFP

PERIOD OF CONTRACT:

The vendor has to execute maintenance as a part of warranty period as per the requirement specified in the following sections. The vendor has to maintain the said hubs for 3 years (4th, 5th and 6th year) after the completion of warranty period (3 years) with similar terms and conditions.

Activities to be carried out by Vendor

The vendor has to carry out the following activities.

1. Comprehensive Annual Maintenance

- 1..1 The vendor shall carry out On Site Comprehensive Maintenance Services for hubs located at J&K and NE region
- 1..2 The details of equipment at hub are as per supply contract of this RFP. The address details of hub will be made available at the time of installation.
- 1..3 Preventive maintenance (PM) of hubs would be done every **three months** during the period of contract, where hub equipment will be thoroughly checked, serviced and adjusted. A comprehensive PM report against each hub shall be submitted to SAC. The format of the report will be jointly finalized at appropriate time.
- 1..4 After every visit, the service engineer should take the signature of the custodian of the site with photograph of the fully installed hub.
- 1..5 The vendor has to prepare detailed maintenance report for each maintenance activity carried out for Hub.
- 1..6 For any problem reported by the user, the problem shall be attended within 4 hours.

2.Terms & Conditions

- 2.1 Vendor has to provide certificates of OEM (Original Equipment Manufacturer) for the equipment used in hub to support maintenance activity related to hub during CAMC period. Offer received from the vendor without providing above certificate will be treated as cancelled.
- 2.2 The term **comprehensive** means Vendor will diagnose repair / replace the faulty component / system / peripherals / software and OS installed for hub with its own resources and equipment within given time frame, make system

operational and all expenditure related to CAMC has to be borne by vendor.

- 2.3 All logistics like arrangement of required transport of equipment and lodging / boarding for maintenance personnel will be the responsibility of vendor.
- 2.4 In the event of the damages to user's property or personal injury to user / vendor personnel due to the negligence of employee of vendor, the responsibility shall be solely rest with vendor. ISRO shall not be responsible for the loss of life of employee of vendor at the time of performance of contract at user agency's premises due to natural calamities / accident explosion etc, if any, the persons engaged by the vendor for carrying out the maintenance work will not have any right or claim for regular employment in any of the ISRO / DOS and these establishments.
- 2.5 For any problem reported by the user, the problem shall be attended within 4 hours for hub. Parts / equipment replaced duly repaired should be of same type & capacity. In case any part is replaced by lower capacity; the original capability should be restored within 3 months. In case of non-availability of identical replacement, suitable new equivalent replacement with similar or better specification should be carried out with approval of SAC.
- 2.6 Replacement of defective spare parts shall be arranged by vendor at no extra charge. The replacement shall be a new part or equivalent functional unit. In case maintenance is held up for spares and if the system is not working, corresponding amount for each system, which is non-functional, shall be deducted from the bill.
- 2.7 The faulty part replaced can be taken by vendor. Vendor should prepare maintenance report for each maintenance activities carried out and sent to the Engineer -in- charge / focal person.
- 2.8 Vendor should define proper call reporting formats and reporting procedures.
- 2.9 As maintenance is comprehensive in nature, vendor should stock spares of essential nature or as recommended by manufacture(s). Vendor is required to furnish their spare management plan as part of their proposal.
- 2.10 Vendor shall be responsible for all types of charges like lodging, boarding, fares etc for visits to hub and various user nodes.

3. Contract Manager

SAC/ISRO will nominate person as Contract Manager for this contract for the purpose of matters related to this CAMC. All correspondences shall be marked in his/her name.

4.Payment terms

- 4.1 Payment will be made on quarterly basis after due signing and submission of every satisfactory comprehensive report.
- 4.2 The bill duly certified by SAC ISRO Nominated personal shall be submitted to Accounts officer, SAC, Ahmadabad for payment.

5. Penalty Clause / LD Clause

- 5.1 The down time is 4 hours for Hub. The faults reported / lodged from the user must be attended and repaired within 4 hours from the time of report of compliant. For each subsequent hour of delay after 4 (four) from the time of lodging the compliant, 0.5% of annual CAMC value with ceiling of 10% of total contract CAMC value of Hub. **Vendor needs to factor and propose sufficient spares & redundancy to maintain this availability.**

6. Arbitration

Dispute, if any, shall be settled mutually, failing which it shall be referred to a one-man arbitrator appointee by the Director, SAC, Ahmedabad in accordance with Arbitration Act 1996, whose decision shall be final and binding on both the parties.

7. Termination of contract

ISRO reserves the right to terminate the contract if the performance of the Vendor is found to be unsatisfactory during its currency of the contract by giving one month's notice in writing without any financial implications on either side.

8. Fall Clause

The charges for the above work shall in no event exceed the lowest charges at which you service the Hub of identical description to any other party during the currency of the contract. If, at any time during the said period, you reduce the charges for similar work to any other customer, you shall forthwith notify the same to us and the charges payable under the contract for the service shall stand correspondingly reduced.

9. Force Majeure

Should a part of whole of the services covered in this contract be delayed due to reasons of force Majeure (for sites identified by ISRO) which shall include Lock-outs, strikes, riots, civil commotion, fire accidents, acts of God and war, stoppage of deliveries by Government, refusal of or the training schedules referred in the respective orders shall be extended by a period(s) not in excess of duration of such force Majeure. Each party undertakes to advise the other as soon as it becomes aware of the circumstances of such force Majeure. So that actions under the provisions of those orders can be mutually reviewed and agreed upon between Vendor and ISRO if the force Majeure conditions extend over a period of six months both the parties of the order shall mutually discuss and arrive at an agreement for continuation or termination of the contract.

ANNEXURE-2

Environmental specifications for hub Antenna and RF equipment

The earth station will be operating under controlled environmental condition. However, the equipment used shall have the capability to following environmental condition.

INDOOR UNITS		
1.	Operating Temperature	0° C to +50° C
2.	Storage temperature	-40° C to + 60 ° C, desirable
3.	Humidity	95% RH @ 40° C
4.	EMI/EMC	As per IEC, class A equipment
OUTDOOR (EXPOSED) UNITS		
5.	Operating Temperature Range	-10°C to +55° C
6.	Storage temperature	-40° C to +60° C, desirable
7.	Humidity	95% Rh @ 40° C
8.	Rain	As per JSS 55555 or equivalent
9.	Dust	As per JSS 55555 or equivalent
10.	Wind speed	
	Operational	60 kmph, Min
	Gusting	80 Kmph Min
	Stowing speed to Zenith	100 kmph, Min
	Survival wind speed	200 kmph, Min

Annexure-3

Specifications of Measuring and Test Equipment

(A) Spectrum Analyzer

Frequency Range : 9 kHz to 40 GHz

Frequency Counter

(a) Resolution : 1 Hz Min.

(b) Frequency span : 0 Hz (zero span), 100 Hz to 40 GHz

(c) Max. Span Accuracy : 1%

Spectral Purity

(a) SSB Phase Noise @ 10KHz offset: <-90 dBc/Hz at 1 GHz

(b) Harmonics, @ -40dBm level : ≤ -60 dBc

Sweep time

(a) Span ≥ 10 Hz : 2.5 ms to 1000 s

(b) span = 0 Hz : 10 micro s to 2000 s

Bandwidth

(a) Resolution Bandwidth (-3dB) : 10 Hz to 3 MHz in steps

(b) video Bandwidths : 30 Hz to 1 MHz in steps

Amplitude

(a) Max.Input level for Protection : +30 dBm

(b) Max.input level for Measurement : +20 dBm

(d) Displayed average noise level, : <-110 dBm for 10 MHz to 3 GHz (300 Hz RBW,10 Hz VBW)

<-105 dBm for 3 GHz to 13 GHz

<-95 dBm for 13 GHz to 40 GHz

(e) Quasi Peak Detector : EMI b/w(6dB),9kHz,120 kHz

Markers : Normal and delta

Trigger : Free run, Video, External

Traces : Min.3

Display : TFT color display

Interface : USB and LAN

Measurement features : C/N Ratio, Adjacent Channel Power and occupied Bandwidth, Channel Power measurement, Phase Noise

	Measurement,
Operating Temperature	: 10 to 40-degree C temperature and 80% RH at 40-degree C
Power Requirement	: 230 +/- 10 % VAC,50 Hz

(B) RF signal Generator

RF Signal Generator 10 MHz to 40 GHz

1. General purpose, wide frequency range, AM & FM features:
 - (a) Frequency Range: 10 MHz to 40 GHz
 - (b) Frequency Resolution: 0.1 Hz
2. Frequency Stability
 - (a) Ageing Rate for reference frequency: 10^{-6} per year
 - (b) Temperature stability for reference frequency: 1×10^{-6}
3. Spectral Purity
 - (a) SSB phase noise at 10GHz on 20KHz off set CW and 1 Hz BW: <-100dBc
 - (b) Harmonics at 20 GHZ at level 0 dBm: < -30 dBc
 - (c) Non Harmonics (>50 KHz carrier offset): < -55 dBc
4. Output Level
 - (a) Range: -105 dBm to + 5 dBm
 - (b) Resolution: 0.1 dB
 - (c) Accuracy (for levels>-100dBm) at 25 Deg C : < +/-1 dB at 10 GHz,0 dBm
 - (d) Frequency response at 0 dBm: < 1 dB
 - (e) VSWR : < 2 at all operating frequencies
5. Modulation shall be AM & FM
 - (a) Amplitude Modulation: Internal, external
 - (i) Modulation Frequency Range(3dB),f >100kHz : DC/ 20 Hz to 20 KHz
 - (ii) Modulation Depth: 0 to 90%
 - (iii) AM Distortion at 1 kHz (m < 80%), 0 dBm : < 5% of reading + 0.2%
 - (b) Frequency Modulation: Internal, external
 - (i) Frequency Deviation: 20 to 100 kHz
 - (ii) Resolution: 1%, min. 1 Hz
 - (iii) Modulation frequency range (-3dB) standard: DC/20 Hz to 80 KHz
6. Memory: 10 Storage settings

7. Digital Sweep

(a) RF Digital Sweep: Automatic single manual or externally triggered

(i) Sweep range and width (lin) : Freely selectable

(ii) Sweep Time: 30 ms to 1 s with resolution of 1 ms.

(b) RF Analog Sweep

(i) Sweep range: Freely selectable

(ii) Sweep Time: 30 ms to 90 s.

8. Interface: IEEE 488/USB/LAN

9. Operating Temperature Range: 5 to 40 degree C

10. Power Requirement: 230 V +/-10% AC,50 Hz +/- 3%

(C) Digital Multimeter

- | | |
|-------------------|---|
| 1. Voltage | : DC 600V, AC 600V |
| 2. DC Accuracy | : +/- 0.5% + 3 digit |
| 3. AC Accuracy | : +/- 1% + 3 digit |
| 4. Resistance | : 40 M Ohm |
| 5. Safety ratings | : CAT III 600 volts |
| 6. Measurements | : AC/DC voltage, resistance, capacitance, diode and continuity test with buzzer |

Annexure-4

Format for price bid

Vendor must fill all the tables given in Annexure-4, including all mandatory and optional items. Failing to do so will lead to disqualification of the bid without further queries. All these tables should be given in the technical bid also with price masked but stating that these have been filled in the commercial quote.

For example see below table:

SI No	Description	Detailed Item Description	Price in INR (Price Masked)
1	Item ABC	Table- XXX	Given in commercial bid
2	Item XYZ	Table- YYY	Given in commercial bid

SI No	Description	Detailed Item Description	Price in INR
1.	Cost of site preparation and civil work for antenna foundation	Table- A	
2.	Cost of Antenna & RF subsystem including 3 year onsite warranty including installation and commissioning as per terms & condition given in Annexure-1	Table- B	
3.	Cost of Hub Monitoring and Control (Hardware and Software) System	Table-C	
4.	Cost of Proposed Test and Measurement equipment with list of deliverable	Table-E	
5.	Cost of Comprehensive Annual Maintenance Contract (CAMC) of Gateways for three years after warranty - 4 th , 5 th & 6 th years	Table-F	
6.	Applicable taxes	Table-G	
	Total		

Optional Items (Vendor must quote):

○ Vendor to quote for following sub-system:

SN	Item	Unit Price (INR)
1	Cost of de-icing subsystem	
	Grand Total	

○ Vendor must accept to provide CAMC for gateways for 7th, 8th, 9th & 10th year if asked by SAC-ISRO at the end of 6th year:

SN	Item	Cost of Comprehensive Maintenance (INR)
1	CAMC for 7 th year	

2	CAMC for 8 th year	
3	CAMC for 9 th year	
4	CAMC for 10 th year	
	Grand Total	

Table-A

Site preparation and civil work for antenna foundation

Sl. No.	Description	Qty	Price per unit	Total Price
1.	Cost of site preparation and civil work for antenna foundation			
1-a	Earth Pits for Antenna, Lightning arrestors Per Antenna 01 Nos			
1-b	Chemical Earth Pits for Equipment Room control & RF for Antenna 01 No.			
1-c	Cable Trays / Trenches From Antenna to Equipment Room Max. Distance of 100 mtr.			
1-d	Site Survey, Detailed Soil testing and Antenna Foundation Pedestal 1.5m Ht. Only from FFL., per Antenna			
	Grand Total			

Note: The activities mentioned in the above table are indicative. However, the vendor shall be responsible for all the works related to site preparation and installation of Gateways, without additional costs.

Table-B

Antenna & RF subsystem

Sl. No.	Description	Qty. per gateway (Main +	Total Qty.	Price per unit	Total Price
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		diversity)			
1.	Provide list of deliverables for each gateways with quantity per gateway (to specify number of items for main and diversity)				
1.1	For example Item-1(name of item)				
1.2	Item-2(name of item)				
1.N	Item - N(name of item)				
	Grand Total				

Table-C

Hub Monitoring and Control (Hardware and Software) System

Sl. No.	Description	Qty per gateway	Total Qty	Price per unit	Total Price
1	Vendor to provide detail list of deliverable with quantity per gateway and total for all four gateway				
1.1	For example Item-1(name of item)				
1.2	Item-2(name of item)				
1.N	Item-N(name of item)				
	Grand Total				

Table-D

Critical spares Proposed by the vendor for during Warranty & CAMC for smooth

maintenance (cost to be borne by vendor)

Sl. No.	Description	Qty. per gateway	Total Qty.
	Vendor to provide detail list of deliverable with quantity per gateway and total for all four gateway		
A	Antenna & RF		
A.1	Item-1(name of item)		
A.2	Item-2(name of item)		
A.N	Item-N		

Table-E

Proposed Test and Measurement equipment with list of deliverable

SN	Description	Make/Model	Qty/Gateway	Total Qty	Price per unit
1	Ka- Band Spectrum Analyzer		1	2	
2	Ka- Band Signal Generator		1	2	
3	Digital Multimeter		1	2	

Table-F

CAMC for 4th, 5th, 6th year:

SN	Item	Cost of Comprehensive Maintenance (INR)
1	CAMC for 4 th year	
2	CAMC for 5 th year	
3	CAMC for 6 th year	
	Grand Total	

Table-G

Applicable taxes:

SI No	Description	Tax rates	Taxes as per Price in INR
1.	Site preparation and civil work for antenna foundation		
2.	Antenna & RF subsystem including 3 year onsite warranty as per terms & condition given in Annexure-1		
3.	Hub Monitoring and Control (Hardware and Software) System		
4.	Proposed Test and Measurement equipments		
5.	Comprehensive Annual Maintenance Contract (CAMC) of Gateways for three years after warranty -4 th , 5 th & 6 th year		
	Total		

Note 1: Bidder to provide any other cost not reflecting in above tables including taxes

Note 2: Vendor to note and agree that SAC reserves the right to procure two more Ka band stations at same price ,terms and conditions given in your quote within time period of one year from date of submission of tender.

ANNEXURE-5

Vendor needs to fill the tables below to share their experiences in the relevant field.

Details of Contracts of Antenna (≥ 7.5 meters) and RF installations as per requirement

Table 10: Experience declaration

Name of Customer & contract No if any	OEM	Antenna diameter and BUC/HPA size	Band of operation	Tx /Rx or Rx only/ Tx only	Contract Award date and Completion date